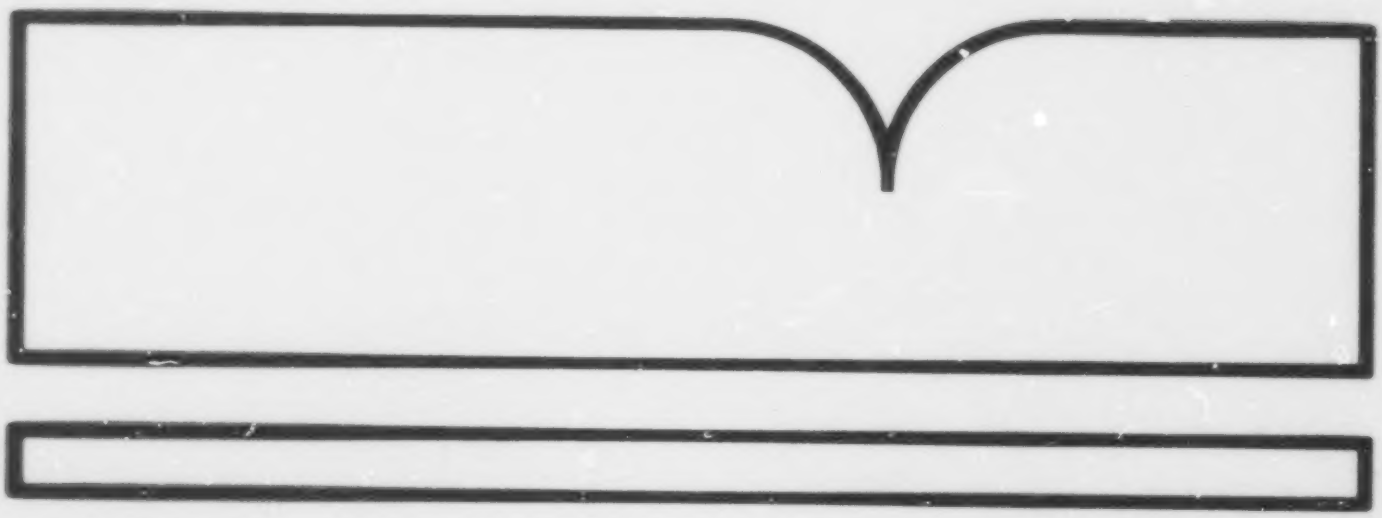
PB88-176052

Health and Environmental Effects Profile for Chlorotoluenes

(U.S.) Environmental Protection Agency
Cincinnati, OH

Jan 85



U.S. Department of Commerce
National Technical Information Service
NTIS

PB88-176052

EPA/600/X-85/045
January 1985

HEALTH AND ENVIRONMENTAL EFFECTS PROFILE FOR CHLOROTOLUENES

ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
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CINCINNATI, OH 45268

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA/600/X-85/045	2.
3. RECIPIENT'S ACCESSION NO. PB88 176052/AS	
4. TITLE AND SUBTITLE Health and Environmental Effects Profile for Chlorotoluenes	5. REPORT DATE January 1985
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Criteria and Assessment Office Office of Research and Development U.S. Environmental Protection Agency Cincinnati, OH 45268	13. TYPE OF REPORT AND PERIOD COVERED
	14. SPONSORING AGENCY CODE EPA/600/22

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The Health and Environmental Effects Profile for chlorotoluenes was prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human health, aquatic life and environmental effects of hazardous waste constituents.

Quantitative estimates have been presented provided sufficient data are available. Existing data are insufficient to determine an Acceptable Daily Intake (ADI) or a carcinogenic potency factor for chlorotoluenes.

The Reportable Quantity (RQ) value of 1, 10, 100, 1000 or 5000 pounds is used to determine the quantity of a hazardous substance for which notification is required in the event of a relase as specified by CERCLA based on chronic toxicity. Existing data are insufficient to determine an RQ value.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

18. DISTRIBUTION STATEMENT Public	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 35
	20. SECURITY CLASS (This page) Unclassified	22. PRICE PC A03/MF A01 $6.95

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

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PREFACE

Health and Environmental Effects Profiles (HEEPs) are prepared for the Office of Solid Waste and Emergency Response by the Office of Health and Environmental Assessment. The HEEPs are intended to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA). Both published literature and information obtained from Agency program office files are evaluated as they pertain to potential human health, aquatic life and environmental effects of hazardous waste constituents. The literature searched and the dates of the searches are included in the section titled "Appendix: Literature Searched." The literature search material is current through November, 1984.

Quantitative estimates are presented provided sufficient data are available. For systemic toxicants, these include Acceptable Daily Intakes (ADIs) for chronic exposures. An ADI is defined as the amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect. In the case of suspected carcinogens, ADIs are not estimated in this document series. Instead, a carcinogenic potency factor of q_1^* (U.S. EPA, 1980) is provided. These potency estimates are derived for both oral and inhalation exposures where possible. In addition, unit risk estimates for air and drinking water are presented based on inhalation and oral data, respectively.

The first draft of this document was prepared by Syracuse Research Corporation under EPA Contract No. 68-03-3228. The document was subsequently revised after reviews by staff within the Office of Health and Environmental Assessment: Carcinogen Assessment Group, Reproductive Effects Assessment Group, Exposure Assessment Group, and the Environmental Criteria and Assessment Office in Cincinnati.

The HEEPs will become part of the EPA RCRA and CERCLA dockets.

TABLE OF CONTENTS

		Page
1.	INTRODUCTION	1
1.1.	STRUCTURE AND CAS NUMBER	1
1.2.	PHYSICAL AND CHEMICAL PROPERTIES	1
1.3.	PRODUCTION DATA	2
1.4.	USE DATA	3
2.	ENVIRONMENTAL FATE AND TRANSPORT PROCESSES	4
2.1.	AIR	4
2.2.	WATER	4
2.3.	SOIL	6
3.	EXPOSURE	7
4.	PHARMACOKINETICS	9
4.1.	ABSORPTION	9
4.2.	DISTRIBUTION	10
4.3.	METABOLISM	11
4.4.	EXCRETION	12
5.	EFFECTS	13
5.1.	CARCINOGENICITY	13
5.2.	MUTAGENICITY	13
5.3.	TERATOGENICITY	13
5.4.	OTHER REPRODUCTIVE EFFECTS	14
5.5.	CHRONIC TOXICITY	14
5.6.	OTHER RELEVANT INFORMATION	15
6.	AQUATIC TOXICITY	18
6.1.	ACUTE EFFECTS	18
6.2.	CHRONIC EFFECTS	18
6.3.	PLANT EFFECTS	18
6.4.	RESIDUES	18
6.5.	OTHER RELEVANT INFORMATION	19
7.	EXISTING GUIDELINES AND STANDARDS	20
7.1.	HUMAN	20
7.2.	AQUATIC	20
8.	RISK ASSESSMENT	21
9.	REFERENCES	22
APPENDIX:	Literature Searched	28

LIST OF ABBREVIATIONS

ADI	Acceptable daily intake
BCF	Bioconcentration factor
K_{oc}	Soil adsorption coefficient
K_{ow}	Octanol/water partition coefficient
LC_{50}	Concentration lethal to 50% of recipients
LD_{50}	Dose lethal to 50% of recipients
NOAEL	No-observable-adverse-effect level
ppb	Parts per billion
ppm	Parts per million
STEL	Short-term exposure limit
TLV	Threshold limit value
TWA	Time-weighted average

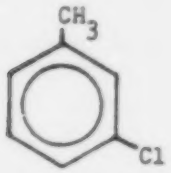
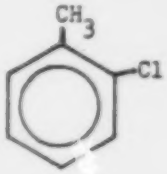
1. INTRODUCTION

Ring-substituted monochlorotoluene exists in three isomeric forms: m-, o- and p-chlorotoluene.

1.1. STRUCTURE AND CAS NUMBER

Synonyms for m-, o- and p-chlorotoluene are 3-chloro-1-methyl benzene, 2-chloro-1-methyl benzene and 4-chloro-1-methyl benzene, respectively. The chemical and structural formulae (Verschueren, 1983) and CAS Registry numbers are as follows:

Structural formula:

m-chlorotoluene	o-chlorotoluene	p-chlorotoluene
		

Empirical formula:

C_7H_7Cl	C_7H_7Cl	C_7H_7Cl

CAS numbers:

108-41-8	95-49-8	106-43-4

1.2. PHYSICAL AND CHEMICAL PROPERTIES

m-, o- and p-Chlorotoluene are colorless liquids with a penetrating odor similar to chlorobenzene (Gelfand, 1979). Other physical and chemical characteristics are as follows (Gelfand, 1979; Verschueren, 1983; Valvani et al., 1981):

	m-	o-	p-
Molecular weight:	126.59	126.59	126.59
Melting point(°C):	-47.8	-35.6	6.5
Boiling point (°C):	161.7	159.2	162.4
Density (g/mℓ) at 20°C:	1.0722	1.0825	1.0697
Vapor pressure (mm Hg at 20°C):	96.3	2.7	96.6
Water solubility at 20°C (g/ℓ):	not available	0.374	0.374
Log octanol/water partition coefficient P_{oct}:	3.28	3.42	3.33

1.3. PRODUCTION DATA

The U.S. EPA (1977) TSCA Production File lists the following manufacturers and production volumes for monochlorotoluenes:

	Manufacturer	Production (million lbs)
o-Chlorotoluene	Tenneco Chemicals	1-10
	Hooker Chemicals	10-50
p-Chlorotoluene	Tenneco Chemicals	1-10

No manufacturer of m-chlorotoluene was identified by the U.S. EPA (1977). SRI International's Directory of Chemical Producers lists Hooker Chemical as the only manufacturer of o- and p-toluenes in 1981 (SRI, 1981). No manufacturers are listed for the years 1982 to present (SRI, 1982, 1983, 1984).

Monochlorotoluenes are manufactured predominantly by direct catalytic chlorination of toluene. Other manufacturing methods include noncatalytic nuclear chlorination of toluene in a variety of organic solvents, reaction of toluene with certain Lewis acid halides, and chlorination of toluene with hydrogen chloride (Gelfand, 1979).

1.4. USE DATA

Monochlorotoluenes are used as solvents and as chemical intermediates in the manufacture of pesticides, dyestuffs, pharmaceuticals and peroxides (Gelfand, 1979).

2. ENVIRONMENTAL FATE AND TRANSPORT PROCESSES

2.1. AIR

Little pertinent data regarding the fate and transport of m-, o- and p-chlorotoluene in air were located in the literature cited in the Appendix. Because of the relatively high vapor pressure of these compounds (Gelfand, 1979), they are likely to enter the atmosphere and, in fact, have been identified in air monitoring studies (Chapter 3).

2.2. WATER

The environmental fate and transport of m-, o- and p-chlorotoluene is not well represented in the available literature. The measured water solubility of o- and p-chlorotoluene was reported by Valvani et al. (1981) as ~0.374 g/ℓ(log molar solubility -2.53). Leo et al. (1971) report experimentally determined log K_{ow} values for all three isomers. The values reported were 3.28, 3.42 and 3.33 for m-, o- and p-chlorotoluene, respectively. Konemann et al. (1979), Moriguchi (1975) and Valvani et al. (1981), all present calculated log K_{ow} values in close agreement with those of Leo et al. (1971).

Leighton and Calo (1981) experimentally determined the air/water distribution coefficient of o-chlorotoluene over the temperature range of 1-23.0°C. Distribution coefficients ranged from 87.4-202.7, and increased with increasing temperature.

The Henry's Law constants calculated for o- and p-chlorotoluene, using the available vapor pressure and K_{ow} values (Lyman et al., 1982), are 0.042 and 0.043 atm-m^3 $mole^{-1}$, respectively. These values suggest (Lyman et al., 1982) that volatilization from water may be rapid and significant in all types of surface waters.

No data are available concerning the hydrolysis of m-, o- or p-chlorotoluene; however, because the chlorine is a ring substituent, hydrolysis is not expected to be an important process in determining the environmental fate of these compounds.

A number of investigators have examined the biodegradability of monochlorotoluenes; however, the environmental relevance of these studies is questionable.

Gibson et al. (1968) examined the degradation of m-, o- and p-chlorotoluenes by Pseudomonas putida in growth media. P. putida cells used in the test had been grown (acclimated) in media with toluene as the sole carbon source. All three chlorotoluenes were degraded, but at less than half the rate of chlorobenzene. Gibson and Yeh (1973) investigated the degradation of p-chlorotoluene by P. putida. The authors identified the degradation process as oxidation by the enzyme toluene dioxygenase, resulting in a primary degradation product of cis-3-methyl-6-chloro-3,5-cyclo-hexadien-1,2-diol.

Higgins et al. (1980) demonstrated the biodegradability of m-chlorotoluene by a pure culture of the methane-utilizing bacteria, Methylosinus trichosporium. Metachlorotoluene was oxidized with the organism by enzymes to m- or p-methyl benzyl alcohol.

Kawasaki (1980) and Sasaki (1978) used the MITI test (OECD, 1981) to assess the biodegradability of o- and p-chlorotoluene. Both researchers classified these compounds as degradation resistant.

Gerike and Fischer (1979), in a review of a number of biodegradation test procedures, indicate that positive results (i.e., the test compound degrades) in the MITI test are probably "safe in an environmental sense."

The authors also indicate, however, that this test procedure often underestimates the biodegradability of a compound; a negative result could be misleading.

2.3. SOIL

Little data regarding the environmental fate and transport of m-, o- or p-chlorotoluene in soil were not located in the literature cited in the Appendix.

K_{oc} values estimated from the formula of Schwarzenbach and Westall (1981) for a hypothetical soil with an organic carbon content of 1% are 7.1, 9.0 and 7.7 for m-, o- and p-chlorotoluene, respectively. These low K_{oc} values suggest that monochlorotoluenes may not adsorb significantly to sediment or soil. The moderate aqueous solubilities and low K_{oc} values suggest that these compounds may significantly leach from soil.

3. EXPOSURE

Chlorotoluenes have been detected in ambient air samples in a number of studies and locations. Harkov et al. (1983) indicated mean ambient air concentrations of o- and p-chlorotoluene in three New Jersey cities. Air samples were collected from July 6 to August 16, 1981, in Newark, Elizabeth and Camden. o-Chlorotoluene was found in 76% of the samples collected in Newark, in 49% of the samples collected in Elizabeth, and in 89% of the samples collected in Camden. Mean ambient concentrations were 0.02, 0.02 and 0.01 ppb for the three cities, respectively. Parachlorotoluene was found in 95, 97 and 97% of the samples collected in Newark, Elizabeth and Camden, with mean ambient air concentrations of 0.21, 0.25 and 0.22 ppb, respectively.

Van Tassel et al. (1981) and Pellizzari et al. (1979) monitored the ambient air concentration of chlorotoluene isomers in the Love Canal area of Niagara Falls, NY. Concentrations ranged from trace to 274 ng/m³ in the Pellizari et al. (1979) study, with chlorotoluene isomers present in 80% of the samples collected. In the Van Tassel et al. (1981) study, ambient concentrations of chlorotoluene isomers ranged from nondetectable to 1642 µg/m³, with compound being present in 50% of the samples collected. The concentrations of o- and p-chlorotoluene found in three other unspecified locations in New York State ranged from <5-5.8 µg/m³ (Van Tassel et al., 1981). Pellizzari et al. (1979) also reported the presence of chlorotoluene isomers in 1 of 11 samples collected in Baton Rouge, LA. The concentration of chlorotoluene was 35 ng/m³.

Because of the lack of appropriate air monitoring data, it is not possible to estimate human inhalation exposure to chlorotoluenes.

STORET contains records of 73 whole water samples from ambient streams and wells that were analyzed for p-chlorotoluenes; p-chlorotoluene was not detected in any of these samples.

Keith et al. (1976) reported the levels of organic compounds in the drinking water of 13 United States cities. The p- isomer of chlorotoluene was detected only in the groundwater of Miami, FL, at a concentration of 1.5 µg/ℓ. Pellizzari et al. (1979) reported trace amounts of chlorotoluene in 2 of 15 drinking water samples collected in Niagara Falls and Buffalo, NY. Elder et al. (1981) monitored chlorotoluene levels in water and sediment samples collected from sites adjacent to hazardous waste disposal areas in Niagara Falls, NY. These authors reported the presence of higher chlorotoluenes, but no monochlorotoluenes were detected.

No experimental information regarding the bioconcentration potential of m-, o- and p-chlorotoluene are available. The equation of Veith et al. (1979) was used to calculate BCF values for these compounds from their respective K_{ow} values. All calculated BCF values indicate that the compounds will be moderately bioconcentrated. The calculated BCF values are 180, 230 and 200 for m-, o- and p-chlorotoluene, respectively.

Human exposure to monochlorotoluenes from food cannot be assessed because of a lack of monitoring data.

4. PHARMACOKINETICS

Pertinent data regarding the pharmacokinetics of chlorotoluenes were located only for o-chlorotoluene.

4.1. ABSORPTION

Wold and Emerson (1974) investigated the pharmacokinetics of o-chlorotoluene in rats. Within 48 hours of a gavage dose of uniformly ring-labeled [^{14}C]-o-chlorotoluene of 320 mg/kg, 11% of the administered label was recovered in expired air, 81% in the urine and 4% in the feces. These data suggest that absorption of o-chlorotoluene from the digestive tract of rats is both extensive and rapid.

More recently, Quistad et al. (1983) treated four male and four female Sprague-Dawley rats with single gavage 1 mg/kg doses of uniformly ring-labeled [^{14}C]-o-chlorotoluene in corn oil. Additionally, two female rats were similarly dosed with 91 or 102 mg/kg. The treated rats were placed in metabolism cages for separation and collection of urine, feces and expired air. Collection at the end of 4 days ranged from 97.8-103% of the total dose of label, 1.4-4.4% as volatiles (exhaled air), 85-92.7% in the urine and 5.3-7.6% in the feces. These data suggest that absorption of o-chlorotoluene is essentially complete from the gastrointestinal tracts of rats treated with 1-100 mg/kg in corn oil. Peak levels of radioactivity in the blood approximating the equivalent of 0.20 ppm o-chlorotoluene occurred within ~2 hours in three male rats treated with single doses of 1 mg/kg. This finding is indicative of rapid absorption of o-chlorotoluene from the gastrointestinal tract of rats. No sex-related differences in absorption or excretion of o-chlorotoluene were apparent.

4.2. DISTRIBUTION

In the pharmacokinetic study by Wold and Emerson (1974) (see Section 4.1.), recovery of 96% of the radioactivity within 48 hours of a single gavage dose of 320 mg/kg of [^{14}C]-o-chlorotoluene left little compound for distribution to body tissues. It seems unlikely from these data that distribution to body depots is a significant factor in the pharmacokinetics of o-chlorotoluene. This was confirmed by data from the study of Quistad et al. (1983). Blood levels of radioactivity at intervals up to 24 hours were determined for male rats treated with single doses of 1 mg/kg [^{14}C]-o-chlorotoluene. Tissue levels of radioactivity were determined for male and female rats 4 days after single doses of 1 mg/kg and for female rats treated with 91-102 mg/kg [^{14}C]-o-chlorotoluene. Blood levels of radioactivity had fallen to <0.05 ppm o-chlorotoluene equivalent by 10 hours and to ~0 ppm by 24 hours. In rats treated with 1 mg/kg, 4-day tissue levels of radioactivity were <1 ppb o-chlorotoluene equivalent in all tissues from females except the skin, which contained ~1 ppb o-chlorotoluene equivalent. Tissue levels were determined in only one, 1 mg/kg dose group male. Levels of radioactivity were <1 ppb o-chlorotoluene equivalent in all tissues except the lungs, kidneys and pericardial fat but not abdominal fat, in which levels equivalent to 5-6 ppb o-chlorotoluene were found. In this rat, the skin contained the equivalent of 11 ppb o-chlorotoluene. In females treated with 91 or 102 mg/kg, highest tissue levels of radioactivity were found in the skin (258 ppb) and kidneys (168 ppm equivalent o-chlorotoluene). The liver and lungs contained 82 and 84 ppb equivalent, respectively. The lowest level (1 ppb) was found in the brain.

4.3. METABOLISM

Wold and Emerson (1974) characterized the radioactivity recovered in the expired air, urine and feces of rats treated wth uniformly ring-labeled [^{14}C]-o-chlorotoluene (see Section 4.1.). The radioactivity in the expired air was identified as unmodified o-chlorotoluene. Three classes of urinary metabolites were identified: various polar metabolites, a mercapturic acid conjugate of o-chlorotoluene and o-chlorohippuric acid, accounted for 36-43, 20-24 and 16-20% of the total administered dose of radioactivity, respectively. Enzymatic hydrolysis of an aliquot of the urine from the treated rats indicated that the polar compounds included the glucuronide conjugate of the phenolic hydroxylation product of o-chlorotoluene. Recently there has been speculation that these phenolic hydroxylation products may be produced by arene oxide intermediates of the parent compound. Arene oxide intermediates in general have been associated with cellular necrosis and oncogenicity (Federal Register, 1981). Unaltered o-chlorotoluene was not found in the urine or feces of these treated rats; fecal excretion products were not further characterized.

Quistad et al. (1983) characterized the radioactivity recovered in the expired air, urine and feces collected from rats treated with [^{14}C]-o-chlorotoluene. At least 84% of the volatile radioactivity was identified as unaltered o-chlorotoluene. [^{14}C]-carbon dioxide accounted for <1% of the applied dose of radioactivity, indicating considerable stability of the aromatic ring. The urinary excretory products found were the same as reported by Wold and Emerson (1974). o-Chlorohippurate accounted for 20-25%, mercapturic acid for 21-33% and o-chlorobenzyl alcohol glucuronide for 22-42% of the applied dose of radioactivity. Other minor metabolites and unaltered o-chlorotoluene each accounted for <2% of the applied dose of label. The

relative proportions of urinary metabolites were similar from rats treated with 1 or 102 mg/kg. Fecal excretion accounted for <10% of the applied dose of radioactivity. Metabolites identified in the feces were the same three that were found in the urine.

4.4. EXCRETION

Data regarding the excretion of o-chlorotoluene were discussed in Sections 4.1. and 4.3. (Wold and Emerson, 1974; Quistad et al., 1983). No additional data were found in the available literature.

5. EFFECTS

5.1. CARCINOGENICITY

Pertinent data regarding the carcinogenicity of the chlorotoluenes were not located in the literature cited in the Appendix.

5.2. MUTAGENICITY

Simmon et al. (1977) reported results of testing the mutagenicity of 71 chemicals identified in finished drinking water in the United States. p-Chlorotoluene was reported to be nonmutagenic in the Ames Salmonella typhimurium assay for reverse mutation using strains TA1535, TA1537, TA1538, TA98 and TA100, both with and without Aroclor 1254-induced rat hepatic S-9 metabolic activation. Testing was conducted both in the standard liquid suspension assay and in dessicators in which the plates were exposed to volatilized p-chlorotoluene. Negative results were also obtained for p-chlorotoluene in the Saccharomyces cerevisiae D3 assay with and without S-9 metabolic activation. (The actual data and concentration tested were not reported.) Mutagenicity studies of o- and m-chlorotoluene were not located in the literature cited in the Appendix.

5.3. TERATOGENICITY

In an abstract of a Russian study, Pis'ko et al. (1981) reported that terata were not observed in rats, mice or guinea pigs exposed to o- or p-chlorotoluene. p-Chlorotoluene was reported to be fetotoxic at a concentration of 0.1 LD_{50}. Additional details were not provided in the abstract. The Federal Register (1983) reported briefly the results of preliminary inhalation studies of the teratogenicity of o-chlorotoluene in rats and rabbits. In a Huntingdon Research Centre study in rats, several fetuses of dams exposed to the highest concentration (9000 mg/m³) had skeletal abnormalities. "No conclusive indication of a treatment-related effect" was observed in fetuses of rats exposed to 1000 or 3000 mg/m³. An

evaluation of this report by Wilson Consulting Service, Inc., concluded that no adverse effect on pregnancy or fetuses was observed in rats exposed to 1000 or 3000 mg/m³ and that the effects reported at 9000 mg/m³ were "nonstatistically significant skeletal abnormalities...[that] may be indirect effects secondary to maternal physiologic reactions..." The maternal physiologic reactions were not specified.

In a preliminary report on the effects of o-chlorotoluene vapor on the pregnancy of New Zealand white rabbits, the Federal Register (1983) stated that "clinical signs of maternal stress were observed in rabbits exposed to 4000 or 10,000 mg/m³." No effects on female reproduction or fetal development were noted.

Pertinent data regarding the teratogenicity of m-chlorotoluene were not located in the literature cited in the Appendix.

5.4. OTHER REPRODUCTIVE EFFECTS

Pertinent data regarding other reproductive effects of the chlorotoluenes were not located in the literature cited in the Appendix.

5.5. CHRONIC TOXICITY

According to an abstract of a Russian study (Pis'ko et al., 1981), prolonged (duration not otherwise specified) administration of p-chlorotoluene by an unspecified route at a dose of 1 mg/kg/day in laboratory animals stimulated hemopoiesis, caused phase changes in the phagocytic reaction of neutrophils, reduced the level of ascorbic acid in the adrenal gland and affected some enzymes and glycogen content of the liver. In an abstract of another Russian study (Tolstopyatova and Zholdakova, 1980) comparing the toxicity of various chlorinated derivatives of toluene, it was reported that the maximum no-effect dose of o- or p-chlorotoluene was 0.01 mg/kg. The toxic manifestations of the two isomers were similar. Further details were not provided in the abstract.

A brief report of inhalation toxicity associated with o-chlorotoluene in rats was contained in the Federal Register (1983). This summary mentioned that statistically significant alterations were observed in "a number of blood and urine parameters and organ weights," presumably associated with exposures of 4000-16,000 mg/m³. No further information was provided.

Pertinent data regarding the chronic toxicity of m-chlorotoluene were not located in the literature cited in the Appendix.

5.6. OTHER RELEVANT INFORMATION

Acute toxic effects of o-chlorotoluene summarized by the ACGIH (1980) are presented in Table 5-1.

From Table 5-1, it appears that an atmospheric concentration of 4290 ppm was far more toxic (100% mortality in rats and mice; 80% mortality in guinea pigs) in one study than were atmospheric concentrations of ~14,000 or 175,000 ppm in other studies. No explanation of this apparent contradiction was offered. Signs of acute inhalation toxicity reported in rodents were a rapid onset of loss of coordination, gasping, prostration, convulsions and vasodilation (ACGIH, 1980).

Dermal application of o-chlorotoluene resulted in a moderate degree of local skin irritation in rabbits and a moderately severe local irritation and weight loss in guinea pigs. Moderate conjunctival irritation occurred in the eyes of rabbits treated with single instillations of undiluted o-chlorotoluene. Corneal damage was evident in the eyes of rabbits treated with one drop of undiluted compound (ACGIH, 1980).

TABLE 5-1

Acute Toxic Effects of o-Chlorotoluene*

Route	Species	Dose	Response
Oral	rats	>1600 mg/kg	LD_{50}
Oral	rats	50-100 mg/kg	No mortality. Moderate to marked weakness. Vasodilation at the higher doses.
Inhalation	rats	4000 ppm x 6 hours	No mortality. Marked vasovasodilation. Loss of coordination within 1.5 hours; prostration within 1.75 hours; and occurrence of tremors within 2 hours.
Inhalation	rats (3)	~14,000 ppm	No mortality. Loss of coordination; vasodilation; labored respiration; narcosis; "red tears."
Inhalation	rats (3)	~175,000 ppm	One death. Severe prostration in survivors.
Inhalation	mice	~4290 ppm	100% mortality. Gasping, ataxia and convulsions within 30 minutes.
Inhalation	rats, guinea pigs	~4290 ppm	100% mortality in rats; 8 of 10 guinea pigs died. Gasping, hyperpnea, ataxia and convulsions within 45 minutes; all comatose within 1 hour.
Dermal	guinea pigs	1 or 10 mL/kg (24 hours)	Moderately severe local irritation. Loss of weight during 2 weeks after administration.
Dermal	rabbits	not specified	24-hour patch test on abraded or intact skin produced moderate skin irritation.

TABLE 5-1 (cont.)

Route	Species	Dose	Response
Ocular	rabbits	1 drop	Moderate erythema of the conjunctiva. Anterior portion of cornea opaque after 24 hours; recovered within 14 days.
Ocular	rabbits	0.1 mℓ	Moderate conjunctival irritation, which disappeared by the fifth day. No corneal damage.

*Source: ACGIH, 1980

6. AQUATIC TOXICITY

6.1. ACUTE EFFECTS

Bringmann and Kuehn (1980) reported that o-chlorotoluene inhibited all cell multiplication in the bacteria, P. putida, at a concentration of 15 mg/ℓ. They also noted that a concentration of 80 mg/ℓ had no effect on cell multiplication in the protozoan, Entosiphon sulcatum, in a static 72-hour exposure. The 24-hour LC_{50} value for Daphnia magna was 74 mg/ℓ (Bringmann and Kuehn, 1977a).

Bengtsson and Tarkpea (1983) determined 96-hour LC_{50} values for the marine copepod, Nitocra spinipes, and the Bleak, Alburnus alburnus, both of which are endemic to the Baltic Sea. The 96-hour LC_{50} values for N. spinipes exposed to m-, o- and p-chlorotoluene are 15-35, 40-50 and 10-20 mg/ℓ, respectively. The Bleak, A. alburnus, was exposed to only o-chlorotoluene. The 96-hour LC_{50} value was 7.8 mg/ℓ.

6.2. CHRONIC EFFECTS

Pertinent data regarding the chronic toxicity of chlorotoluenes were not located in the literature cited in the Appendi·

6.3. PLANT EFFECTS

Bringmann and Kuehn (1977b, 1980) reported that no effect occurred on cell multiplication in the alga, Scendesmus quadricauda, exposed to a concentration of 100 mg/ℓ o-chlorotoluene for 7 days.

6.4. RESIDUES

As previously noted (see Chapter 3), no experimental information is available concerning residues or bioconcentration potential of chlorotoluenes. The calculated BCF values (c· lated according to Veith et al., 1979) are 180, 230 and 200 for m-, o- and p-chlorotoluene, respectively.

6.5. OTHER RELEVANT INFORMATION

Juhnke and Luedemann (1978) determined an LC_{50} value of 78 mg/ℓ for the ide, Leuciscus idus, exposed to o-chlorotoluene for an unreported duration. Applegate et al. (1957) noted stress in fingerling rainbow trout, Salmo gairdneri, and larval sea lamprey, Petromyzon marinus, exposed to 5 mg/ℓ o-chlorotoluene for 24 hours. Konemann (1981) reported a 7-day LC_{50} value for guppies, Poecilia reticulata, exposed to m-chlorotoluene and a 14-day LC_{50} value for guppies exposed to p-chlorotoluene. The values are 18.3 and 5.92 mg/ℓ for m- and p-chlorotoluene, respectively.

7. EXISTING GUIDELINES AND STANDARDS

7.1. HUMAN

The ACGIH (1983) has recommended a TWA-TLV for o-chlorotoluene of 50 ppm (~250 mg/m³) and a STEL of 75 ppm (~375 mg/m³), based primarily on analogy with other chlorinated aromatics (particularly the chlorinated benzenes) because so few data are available on the toxicity of inhaled chlorotoluenes, and the available data are contradictory (ACGIH, 1980).

No standards or recommendations have been established for m- or p-chlorotoluene.

7.2. AQUATIC

No aquatic guidelines have been established for chlorotoluenes. Available data indicate that toxicity occurs at concentrations as low as 5.92 mg/ℓ for some isomers of chlorotoluene.

8. RISK ASSESSMENT

No studies of the carcinogenicity of the chlorotoluenes in laboratory animals and no reports of carcinogenicity in humans associated with the chlorotoluenes have been located in the literature cited in the Appendix. No adequate chronic or subchronic studies of the toxicity of the chlorotoluenes have been located that enable calculation of an ADI for human exposure. The Federal Register (1983) alluded to an inhalation study in which exposures of rats to 4000-16,000 mg/m³ o-chlorotoluene resulted in changes in blood and urine parameters and organ weights. o-Chlorotoluene exposure may have resulted in skeletal abnormalities in rat fetuses of dams exposed by inhalation to 9000 mg/m³; exposures of 1000 or 3000 mg/m³ were without effect (Federal Register, 1983). Inhalation of o-chlorotoluene at concentrations of 4000 or 10,000 mg/m³ by rabbits resulted in signs of maternal stress (Federal Register, 1983). These studies were not available for criteria evaluation. p-Chlorotoluene was reported as negative for mutation in Salmonella typhimurium and Saccharomyces cerevisiae with and without metabolic activation (Simmon et al., 1977).

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APPENDIX

LITERATURE SEARCHED

This profile is based on data identified by computerized literature searches of the following:

CA SEARCH (Files 308, 309, 310, 311, 320)
TOXLINE
RTECS
CHEM IADS
STORET
SRC Environmental Fate Data Bases
SANSS
AQUIRE
TSCAPP

These searches were conducted in July, 1984. In addition, hand searches were made of Chemical Abstracts (Collective Indices 7 and 8th), and the following secondary sources were reviewed:

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